

EEL 6764 001: Graduate Computer Architecture

Spring 2025

Instructor: Dr. Srinivas Katkoori

Homework 3

Instruction Level Parallelism – Pipelining

Assigned on Monday, 31st March

DUE: 11:59:59PM, Monday, 14th April via Canvas

Upload your solutions in PDF format.

No late work will be accepted.

For some questions, we refer to the exercise problems in the H&P textbook (6th edition). If certain information is not provided, make reasonable assumptions of your own, and use those assumptions to approach the solutions. Make sure that in your solutions, state your assumptions clearly.

- 1) (10 pts) Data Hazards and Pipeline Timing – Solve problem C.1 on pages C-71 and C-72.
- 2) (15 pts) Branch Hazards – Solve problem C.2 on page C-72.
- 3) (15 pts) Deep Pipeline Performance Analysis – Solve C.7 on page C-75
- 4) (20 pts) The following series of branch outcomes occurs for a single branch in a program. (T means the branch is taken, N means the branch is not taken).
Index 1 2 3 4 5 6 7 8 9 10 11 12 13
T, T, N, T, N, T, T, T, T, N, T, T, N
(a) Assume that we are trying to predict this sequence with a Branch History Table (BHT) using a 1-bit prediction. The counters of the BHT are initialized to the N state. Which of the branches would be mispredicted? Show their indices.
(b) Repeat the above exercise with a 2-bit predictor as shown in Figure C.15 initialized to 10.
- 5) (10 pts) Performance Evaluation – Solve 3.1 on page 266.
- 6) (10 pts) Ideal Dependency Detection – Solve 3.2 on page 267
- 7) (20 pts) Dynamic Scheduling Draw the basic structure of a RISC-V floating point unit for Tomasulo's algorithm. Explain how code is executed with an example.
